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ABSTRACT

The National Action Council for Minorities in Engineering (NACME) mentors underrepresented students and encourages their significant achievements in science, mathematics, and engineering. NACME develops many of its mentoring strategies through its Corporate Scholars Program (CSP), a comprehensive scholarship program that links engineering undergraduates to major technology-intensive companies for internship, professional development, and mentoring. This paper examines the role of mentoring and the internship experience in this successful program. Each year, NACME surveys CSP scholars and supervisors to provide feedback regarding components of successful internship and mentoring experiences. In 1997, NACME distributed surveys to 87 NACME scholars with CSP internships and their supervisors. The surveys examined their satisfaction with the program. Results indicated that successful mentoring made a significant difference, contributing substantially to interns' interest in returning to their host companies and their overall evaluation of workplace experiences. Students and supervisors differed significantly in how they viewed and interpreted the experience. The investigation led to four recommendations: recognize the value of teaming; invest time in developing engineering talent; respect the ambition and abilities of interns; and engage interns in exploring future possibilities. (SM)

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Research Letter

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The Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring

is presented with the gratitude of your fellow citizens by

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for embodying excellence in mentoring underrepresented students and encouraging their significant achievement in science, mathematics, and engineering.

William J. Clinton

William J. Clinton
THE WHITE HOUSE
September, 1996

SP038 304

Mentoring Matters

Robert J. Highsmith, Ronni Denes and Marie M. Pierre

In 1996, NACME received the Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring ". . . for embodying excellence in mentoring underrepresented students and encouraging their significant achievements in science, mathematics and engineering." The citation for the award declared ". . . that role modeling and mentoring are important ingredients to the development of talent among groups traditionally underrepresented in these fields," and cited NACME for outstanding mentoring efforts and programs that have enhanced the participation of individuals from these groups.

Many of NACME's mentoring strategies have been developed through its Corporate Scholars Program (CSP). A comprehensive scholarship program that links engineering undergraduates to major technology-intensive companies for internship, professional development and mentoring experiences, CSP produces skilled engineers prepared to achieve at high levels whether in a corporate office, an R&D laboratory or a graduate institution. In the following, we examine the role of mentoring and the internship experience in this successful program.

Introduction

The Corporate Scholar's Program (CSP) prepares a diverse corps of technical leaders for the nation's engineering work force by offering students substantial need- and achievement-based scholarships ($12,000-$20,000), academic enrichment, a NACME trained industry mentor, career guidance, professional development and a structured internship experience designed to produce a highly skilled graduate. The mentoring component provides CSP Scholars with numerous benefits, principally in the form of advice and counsel from experienced professionals and an inside look at the realities of the workplace. In addition, mentoring offers employers valuable opportunities to steep interns in corporate culture, engage them in a developmental process that may lead to future employment, and recruit high performing interns as company employees. It is important to note, however, that companies that mentor interns devote considerable time and resources relative to the number of actual hires. Most are dedicated to the development of diversity in the ranks of engineering graduates and to a rapid expansion of well-trained, available talent.

Because the demand for engineers and other technically trained people is growing, and enrollment in engineering programs is declining,[1] the importance of the Corporate Scholars Program cannot be overstated. CSP is uniquely capable of increasing the flow of talent into the engineering pipeline at a time when the unemployment rate for engineers is only 1.5 percent, about a third the rate of the work force as a whole (4.3 percent).[2] In particular, CSP provides opportunities for

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minority students, who — at 29.7 percent of the college-age population but only 10.0 percent of the engineering graduates in 1997— are still severely underrepresented in engineering.

By all conventional performance measures, CSP has been successful in responding to the students' and nation's needs. Recruited in the latter half of their freshman year, CSP candidates, who need only a 2.5 grade point average (GPA) to participate, achieve an average GPA of 3.2 by graduation. A remarkable 34 percent of CSP graduates go on to top graduate schools and 49 percent are hired by NACME supporting companies. Retention of CSP students stands at 83 percent, far above the 36 percent average for minority engineering students nationally and significantly higher than for nonminority students (59 percent).[3]

Each year, NACME surveys CSP scholars and supervisors to provide participating corporations with feedback regarding the components of successful internship and mentoring experiences for NACME's scholars. The results, however, yield insights for all companies and other organizations seeking to enhance student participation in the technical workforce. Given the opportunity provided by the Presidential Award to assess CSP results anew, we set out to identify key components that make a demonstrable contribution to the success of CSP mentoring and internship programs.

The Study

In June 1997, NACME distributed survey questionnaires to 87 NACME scholars who had received CSP internships during the summer of 1997, inviting them to evaluate the experience.[4] Each intern was given a survey for his/her supervisor to complete as well. Eighty-five interns and 56 supervisors returned completed survey questionnaires, representing response rates of 98 percent and 64 percent,[5] respectively.

In preparation for the analysis, we selected three measures of student satisfaction with their corporate experiences:

- Satisfaction with the ***mentoring*** experience;
- Satisfaction with the ***internship*** experience;
- Willingness to return to the company.

We believed at the outset that the parts of the CSP program that increased interns' perceptions of benefit from their mentoring and internship experiences and that enhanced their desire to return to the company constituted evidence of success that should be celebrated and disseminated widely. In particular, willingness to return to the company was important not simply as evidence of a strong umbilical cord between the student and his or her sponsor, but because it suggests commitment to engineering as a career and clear identification of a possible employment goal, both significant predictors of student retention.[6]

Given the high degree of student satisfaction with the program overall, we searched the student and supervisor databases for questions on which sufficient variation in the opinions of respondents existed to compare interns and supervisors who were satisfied and those who were not; we elected to report comparisons only for questions on which at least 15 percent of the respondents reported unhappy experiences. As expected, our investigations reaffirmed previous studies of CSP's effectiveness. However, we also made new discoveries that we believe to be of interest beyond those most intimately involved with CSP.

The Findings: Mentors Matter

Significant differences in NACME scholars' experiences, revealed in their responses to our post-internship survey, lead cumulatively to one conclusion: mentoring matters. Whether performed by individuals formally assigned the role of mentor, or by supervisors and others performing the duties of mentors, successful mentoring contributes substantially to interns' interest in returning to their host companies and their overall evaluation of workplace experiences. Unsuccessful mentoring has the reverse effect.

Overall, companies with mentoring programs in which mentors and interns (1) serve on the same company teams, (2) have regular personal contact during the summer, and (3) anticipate continuing contact during the academic year related to the interns' college work, are more successful in cultivating interns with a desire to return than companies with mentoring programs that offer different benefits.

Serving Together on Company Teams

Teaming, which is highly valued in the nation's leading high technology companies for its ability to raise quality and productivity, also had important benefits in the intern/mentor relationship. Interns who served on company teams with their mentors, one of every two surveyed, had considerably greater interest in returning to their companies and higher evaluations of the mentoring and internship experiences than other interns. As indicated by Figure 1, 94 percent of the interns who served on teams that included their mentors expressed a desire to return to the company, and 97 percent of those students perceived both their mentoring and their overall internship experiences as positive. In contrast, only 70 percent of interns who did not serve on teams with their mentors felt that their mentoring experience was positive. Slightly fewer than eight out of ten in this group expressed a desire to return to the company.

Personal Contact

Successful mentoring is a time-intensive proposition. When interns felt they had adequate summer contact with their mentors, they rated their mentoring and internship experiences more favorably and were considerably more interested in returning to their companies. Figure 2 reveals that 93 percent of interns who felt they had sufficient contact with their mentors expressed a desire to return to the company, and they were similarly positive in their overall assessments of the internship and mentoring experiences. On the other hand, interns who felt they had too little contact with their

Figure 1.

Mentor/Intern Teaming

Impact on Student Perceptions

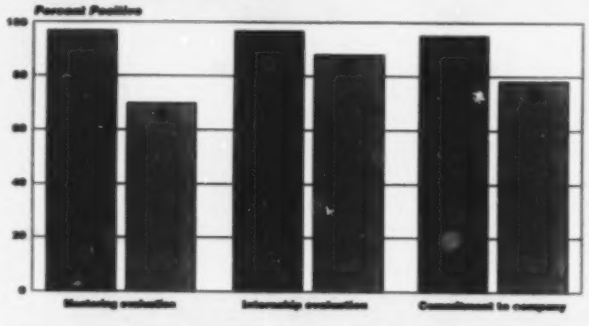


Figure 2.

Sufficient Student/Mentor Contact

Impact on Student Perceptions

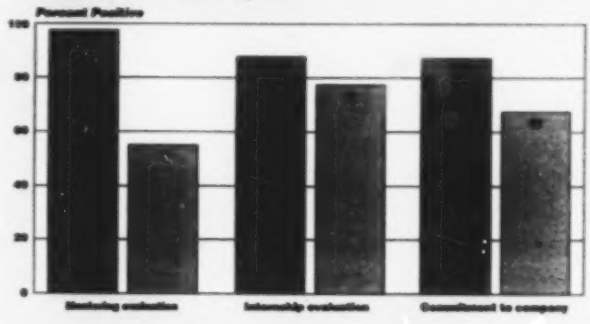


Figure 3.

Expectations of Mentor's Future Helpfulness

Impact on Student Perceptions

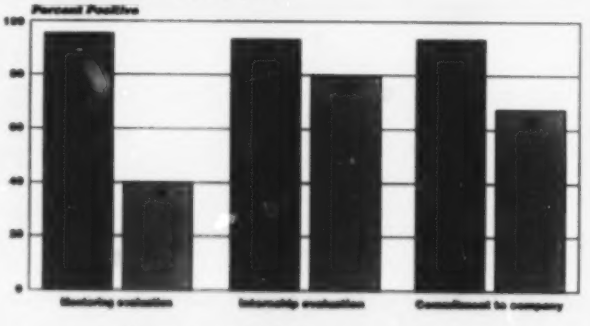


Figure 4.

Desire for Academic Year Contact with Mentors

Impact on Student Perceptions

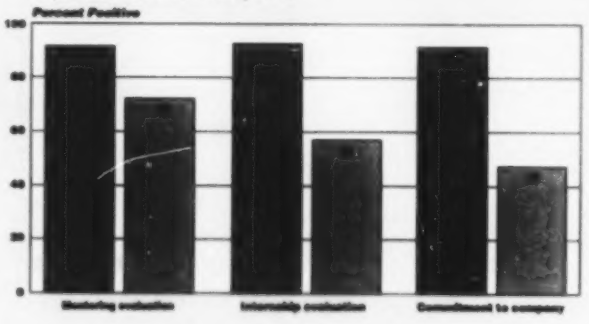


Figure 5.

Mentors' Influence on Academic Performance

Impact on Student Perceptions

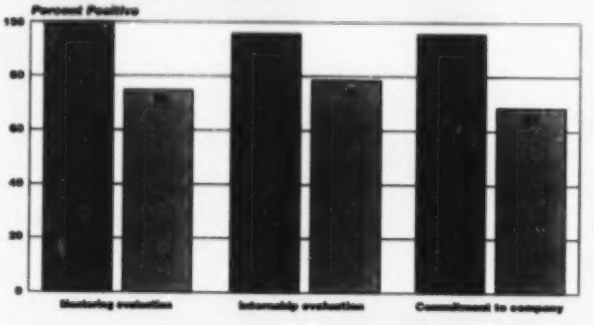
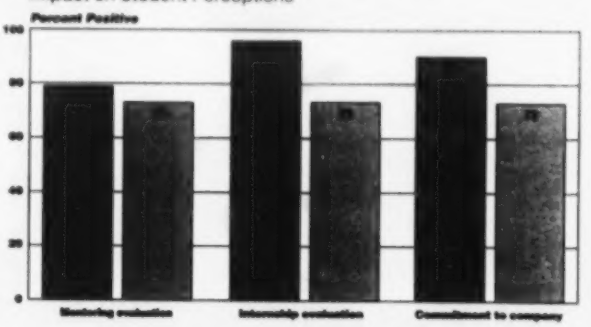


Figure 6.

Regularity of Feedback from Supervisors

Impact on Student Perceptions



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mentors during the summer were 26 percentage points less interested in returning to their companies, 43 percentage points less likely to evaluate the mentoring experience favorably and 15 percentage points less likely to judge their internships positively. (None of the interns indicated that they had too much contact with their mentors.) These findings were supported by the discovery that as the frequency of meetings between the interns and their mentors increased, from one meeting during the summer to meetings every day or two, the interns' interest in returning to the company increased, as did their overall assessment of the mentoring and internship experiences.

Opportunities for Continuous Learning

Academic support by mentors gets high marks from interns too. Interns who come to expect that their mentors will be helpful in their future college work and who express a desire for contact with their mentors during the academic year are more interested in returning to their companies and have more favorable assessments of mentoring and internships than interns who do not form such expectations and desire no contact. Figures 3 and 4 display the effects. Nineteen out of 20 interns who developed expectations that their mentors would be helpful in the future report a desire to return to their companies, compared with the 13 out of 20 interns interested in returning when mentors were not seen as potential supporters of college achievement, a 28 percentage point difference. Even greater is the contrast between interns who want contact with their mentors during the academic year and those who do not. Ninety-two percent of the interns interested in on-going contact desire to return compared with only 43 percent of interns shunning contact, a 49 percentage point difference! Clearly, students have a desire to learn from their mentors. When the relationship established between students and mentors leads students to expect that they will receive help and maintain on-going contact, students reciprocate by making a greater commitment to their companies, relative to interns with less satisfactory mentoring relationships.

The interns who reported that their mentors had a positive influence on their academic performance also had considerably more favorable perceptions of the internship experience, as indicated by Figure 5. Ninety-six percent of the interns who reported that their mentors contributed positively to their academic performance expressed interest in returning to the company compared to 67 percent of interns whose mentors made no such contribution. Fully 100 percent of the interns who experienced support of this kind had favorable impressions of the mentoring experience versus 72 percent of those who did not, and they were more positive about their internships overall (96 percent vs. 78 percent).

It is clear from these findings that the time invested and the quality of the relationship that a mentor builds with a student intern can have a tremendous impact on an engineer's experience and aspirations. Mentors significantly influence interns' overall assessment of the internship experience and their desire to be associated with a company. Interns who serve on company teams with their mentors, have adequate contact during the summer with their mentors, and build relationships that lead to expectations of help from and continuing contact with their mentors during the academic year are interns who express a desire to return to companies they served. In structuring their mentoring programs around these attributes, companies can enhance the interns' experience and increase the companies' possibility of converting a valued intern to a high performing employee.

Supervisors Matter Too

Supervisors play a variety of formal and informal mentoring roles with interns, and, in so doing, they affect interns' assessment of their mentoring and internship experiences.

Like mentors, supervisors must make a substantial time commitment to effectively manage student interns. Figures 6 to 8 reveal the effects of time spent by supervisors with interns and the regularity of their interactions. Interns who receive regular feedback from their supervisors are 18 percentage points more likely to want to return to their companies than other interns and 23 percentage points more likely to evaluate the internship positively. The amount of time a supervisor spends with an intern also correlates positively with interns' attitudes. As the amount of time supervisors spend with interns increases, interns' interest in returning to their companies, in general, rises. Seventy-six percent of interns whose supervisors spent 0-2 hours per week were interested in returning to their companies; the percentage increased to 82 percent when supervisors spent 2-5 hours, and further increased to 92 percent of interns when supervisors spent 5-10 hours. A similar pattern emerged in interns' assessment of the overall internship experience. Figure 8 shows that the amount of time supervisors spend with interns is related to supervisors' attitudes also. Supervisors who spend more time with interns are slightly more likely to regard interns as potential employees and a bit more likely to take concrete steps to ensure that their interns do, in fact, become future employees.

The bond established when mentoring and supervision are provided to a student by a single person was particularly strong. All of the students whose mentors also served as their supervisors indicated a desire to return to the company they served as interns. Specifically, a corporate representative who serves both as mentor and supervisor adds eight percentage points to the interns' positive overall assessment of the mentoring experience and twelve points to the interns' interest in returning to their companies.

Giving interns choices generates benefits as well. When supervisors have given interns some degree of freedom

Figure 7.

Time Spent with Supervisors

Impact on Student Perceptions

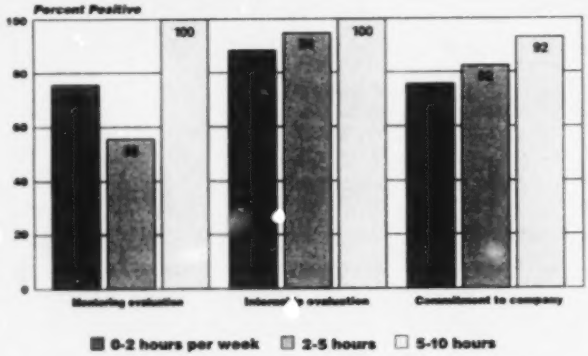


Figure 8.

Time Spent with Interns

Impact on Supervisor Perceptions

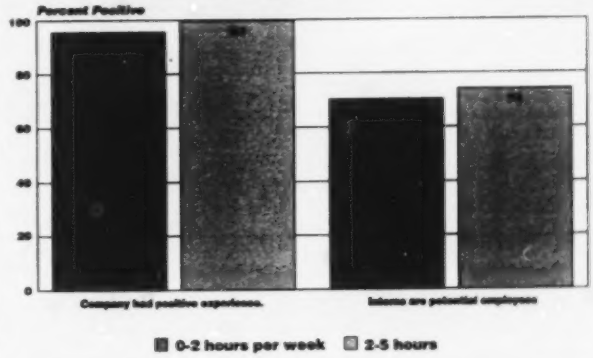


Figure 9.

Freedom to Choose Assignment

Impact on Supervisor Perceptions

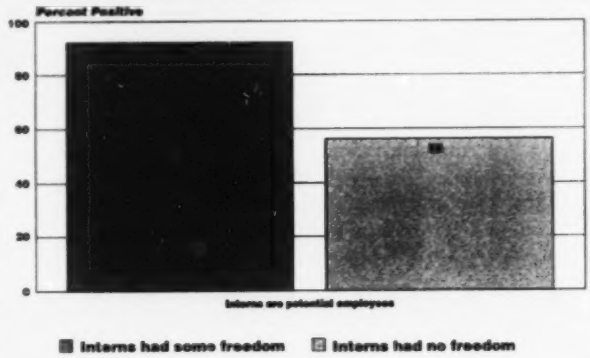


Figure 10.

Opportunity to Work on a Team

Impact on Student Perceptions

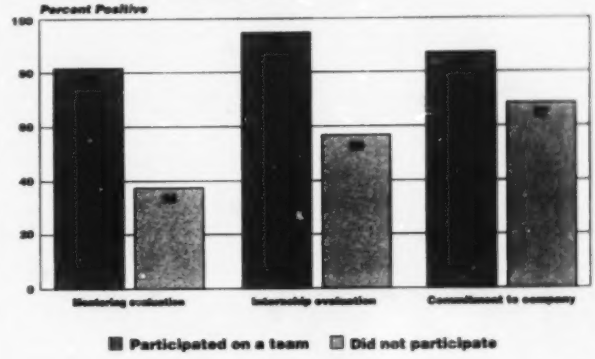


Figure 11.

Satisfaction with Technical Expertise Required

Impact on Student Perceptions

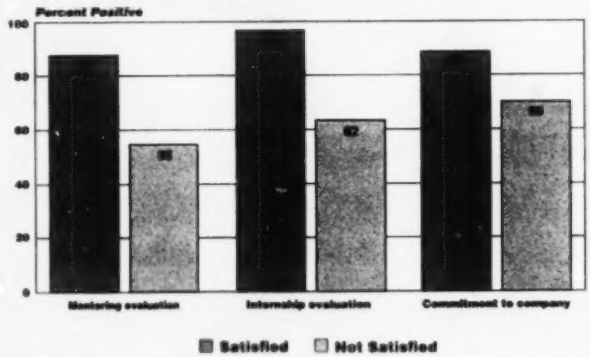
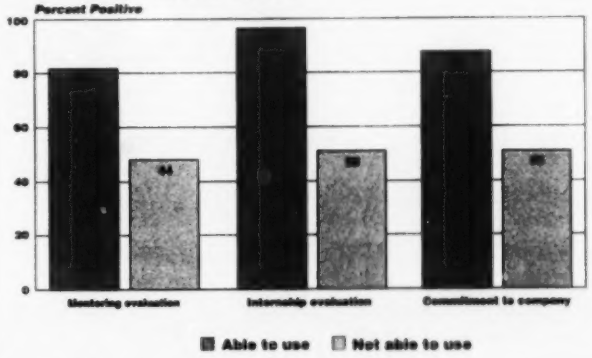


Figure 12.

Opportunity to Use Academic Skills

Impact on Student Perceptions



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in their assignments, the supervisors are more inclined to regard the interns as potential employees compared with other interns. Of the supervisors who reported that their interns had some freedom in choosing their assignments at the outset of the relationship, 91 percent viewed such interns as potential future employees at the end of the internship (see Figure 9). This compares with only 56 percent of the supervisors, not inclined or able to provide such freedom, who viewed the interns as potential future employees. It appears that interns with greater freedom to choose perform on their assignments at a level that creates favorable impressions with their supervisors and enhances companies' consideration of the interns as prospective employees. Or, it is possible that supervisors who enter the relationship believing that it is a valuable opportunity to nurture a future hire may provide options in assignments, function in a more supportive capacity and favorably impact both their own and the intern's assessment.

In investing time in interns, supervisors generate substantial dividends for their companies and important benefits to the students to whom they are assigned. There is a direct relationship among (1) the time spent by supervisors with interns, (2) the value interns place on their mentoring and internship experiences, and (3) interns' interest in and likelihood of returning to their companies. Even in cases where supervisors believe they have spent too little time helping interns, a direct relationship was discovered among the time the supervisors give and their interest in interns as potential employees, their readiness to take action to recruit the interns as future employees and interns' positive overall assessment of the internship experience.

Differences in Responses of Interns and Supervisors

Despite the great value that students placed on supervisors, there was a remarkable divergence in the way students and supervisors viewed and interpreted the internship experience. Supervisors consistently gave themselves higher average ratings and perceived their management of the internships to be more successful than the interns did. Examples of this pattern showed up in analyses of the levels of feedback and support provided by supervisors to the interns, the importance of the projects assigned, and satisfaction with interns' on-the-job performance. Whereas nearly 100 percent of the supervisors reported that they gave regular feedback, fewer than seven out of ten interns shared that perception (98 percent vs. 67 percent). Similarly, more than 93 percent of the supervisors indicated that the interns' mentors had been supportive, compared with fewer than 79 percent of the interns. Virtually all of the supervisors (98 percent) felt that the projects to which they had assigned interns were important compared with just 88 percent of the interns who shared that belief. More than nine of ten supervisors were satisfied with the interns' performance on the job, compared with 86 percent of the interns who were satisfied with their own performance.

Finally, in one fascinating, counterintuitive finding, supervisors who judged their NACME interns to be in the top quartile of all interns who had worked at the company were less likely to have taken actions to see that their interns became future employees than supervisors of interns that were judged to be in the second quartile (44 percent vs. 63 percent, respectively). Although we speculate that this may be related to the challenges of retaining employees from the top quartile of minority engineering recruits, further exploration of that possibility was impossible with the data available. The low numbers for both groups of supervisors reveal that companies may not be acting aggressively to induce continuing commitments from their interns at this early stage.

Work Assignments Make a Difference

Students want a challenging, stimulating, intellectually satisfying experience. Interns given opportunities to work in company teams, use their technical expertise, discover a relationship between their assignments and their career goals and academic backgrounds, and identify potential role models judge their mentoring and internship experiences more favorably and express interest in returning to their companies in substantially greater numbers than interns without such opportunities. They also value the care and consideration evident when companies manage their summer living arrangements effectively.

Serving on a Company Team

Teaming was remarkably effective in rapidly inculcating a sense of belonging among summer engineering interns. Even when their mentors did not serve alongside them, interns who had opportunities to work as part of a company team gave consistently higher appraisals of their companies and of their mentoring and internship experiences than interns who did not (see Figure 10). Interns participating on such teams expressed greater interest in returning to their companies, by 18 percentage points, than their peers who did not. In addition, slightly more than eight interns out of ten with team experience judged the mentoring experience favorably compared with fewer than four out of ten who did not. Ninety-four percent of the interns who participated on teams judged their internship favorably, compared with 56 percent of their peers who did not participate in teams.

Using Technical Expertise

Although relatively young and inexperienced compared with their co-workers, interns evidence clear ambition to flex their technical muscles. In fact, the technical expertise expected by their companies was a major factor in interns' overall interest in preserving a relationship with a company, as indicated in Figure 11. Slightly fewer than seven out of ten interns who were not satisfied with the level of technical expertise required during their internships expressed a desire to return to the company. These interns were even more critical of their mentors, with only 56 percent reporting a positive overall experience with their

Figure 13.

Assignments Related to Future Coursework

Impact on Student Perceptions

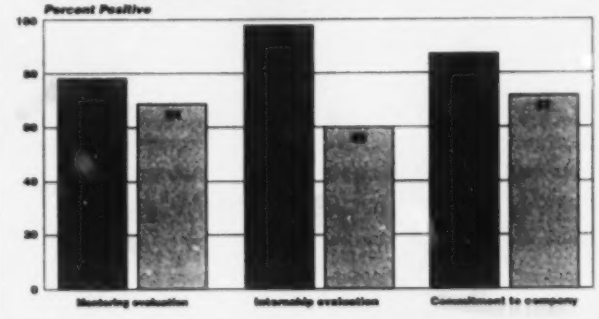
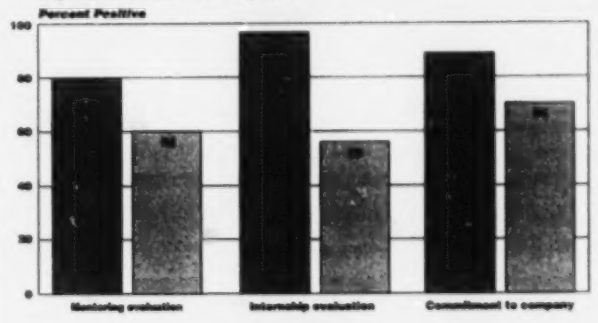


Figure 14.

Assignments Related to Career Goals

Impact on Student Perceptions



mentors and only slightly more than six out of ten expressing satisfaction with the internship experience. These findings contrast with those of interns who expressed satisfaction with the level of technical expertise required of them. Of this group, 89 percent expressed an interest in returning to the company. They liked both the mentoring and internship experiences as well, with 87 percent expressing satisfaction with their mentoring experience and 97 percent declaring their satisfaction with the internship experience.

Using Academic Skills

Similar to the gratification provided by the opportunity to contribute in the technical arena, our scholars responded positively to assignments which permitted them to apply their academic skills. Interns whose assignments drew upon their university training or related to their future coursework rated their desire to return to their companies, and the overall mentoring and internship experiences, considerably higher than interns whose assignments did not. As indicated in Figure 12, of interns whose assignments required use of their academic skills almost nine out of ten expressed a desire to return to the company, more than eight out of ten valued the mentoring experience, and virtually all reported a positive experience as interns. Among those not required to use their academic skills, only one-half expressed an interest in returning to the company, only 44 percent felt that their mentoring experience had been positive, and only 50 percent judged the internship to be positive. Figure 13 reveals similar discrepancies among interns' whose assignments related to their future coursework and those whose did not.

When assignments related to their career goals, interns reacted much more favorably to a company, its mentoring program and the internship experience compared to interns whose assignments did not. Figure 14 reveals that interns who felt that their assignment was related to their career goals were 23 percentage points more interested in returning to their companies than interns who did not agree (87 percent vs. 64 percent). In addition, 97 percent of the interns given assignments related to their career goals evaluated the internship favorably overall, and 80 percent judged the mentoring experience favorably as well. Only 55 percent of interns given assignments that they saw as unrelated to their career goals agreed that the internship experience was a positive one and only six out of ten judged the mentoring experience positively as well.

Meeting Role Models

Young people setting out upon a career path are eager to find figures to respect and emulate, and the CSP students were no exception. Interns who met someone at the company whom they regarded as a potential role model were more favorably impressed with their companies, and rated their mentoring and internship experiences higher, than interns who did not (Figure 15). Ninety-two percent of interns who met someone they saw as a potential role model expressed a desire to return to their company compared to 8's percent of interns who did not. Almost nine out of ten of those who discovered a potential role model had an overall favorable assessment of the mentoring experiences, and 95 percent of them had a favorable assessment of the overall internship experience. This compares with the 41 percent of the interns, unable to find a role model, who felt that their mentoring experience was positive and the 72 percent of the same group who expressed satisfaction with the overall internship experience.

As might be expected, interns who met someone of their own race/ethnicity whom they regarded as a potential role model evaluated their internship experiences more favorably, although the differences were not meaningful. As shown in Figure 16, whereas 89 percent of NACME interns who met such individuals wanted to return to their companies, 77 percent of interns who did not wanted to do so. Although 84 percent of NACME interns who met such an individual had a favorable mentoring experience and 96 percent had a positive internship experience, interns who did not find such a role model

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Figure 15.

Meeting Potential Role Model

Impact on Student Perceptions

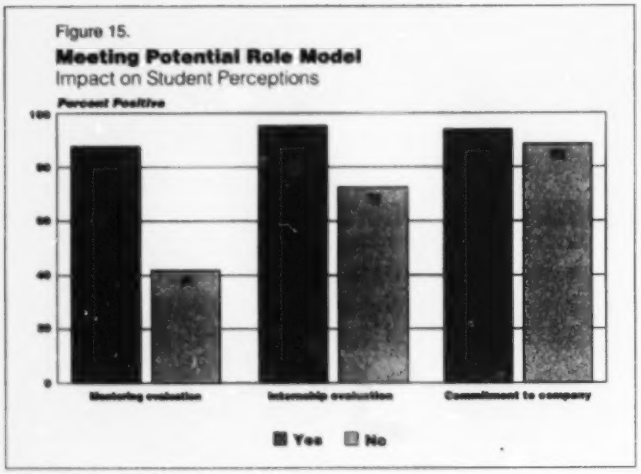
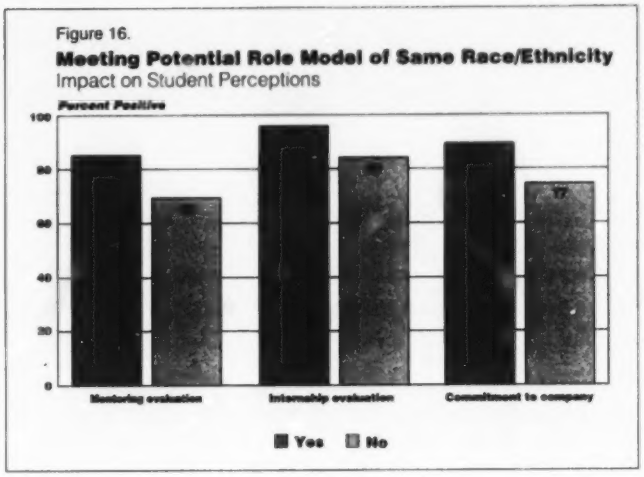


Figure 16.

Meeting Potential Role Model of Same Race/Ethnicity

Impact on Student Perceptions



had less agreeable experiences both with their mentors and as interns (68 percent and 83 percent, respectively). But, it must be emphasized, having access to role models at all made a greater difference to the interns than having access to role models of their own race and/or ethnicity in their assessments of the mentoring and internship experiences.

Well Managed Living Arrangements

Although substantial numbers of interns reported that their department was not prepared with work assignments for them on their first day, that appeared to have no lasting impression on the interns' opinions of their companies, or on their assessment of the mentoring and internship experiences. Not so with interns who reported that their living arrangements were not managed smoothly. Whereas 92 percent of interns whose living arrangements were handled smoothly reported an interest in returning to their company, only 70 percent of those whose living arrangements were not handled smoothly expressed the same interest (Figure 17).

Other Influences

The surveys of interns and supervisors on which this report is based inquired into scores of influences that had potential to bear on the success of mentoring and internship programs. However, only the small handful of reported influences made substantial contributions to the interns' evaluations of their experiences. Among the many influences that did not make a difference despite expectations to the contrary are two that may be of particular interest: the variety of experiences that companies provide for interns, and the diversity found in the workplace.

We inquired about the effects of a broad array of experiences that companies provided for interns, including participation in company training and/or intern training, the chance to interact with executives and opportunities to participate in company social and extracurricular activities. Despite the fact that significant numbers of interns were not given opportunities to participate in such activities, no systematic relationship was discovered among those who were afforded such opportunities, those who were not, and their assessments of the companies for which they worked, or the overall mentoring and internship experiences. Also, in asking interns about diversity issues, it might be expected that companies with greater diversity would be regarded more favorably by NACME scholars than other companies. However, the data did not support such expectations. Although there was considerable variation across companies in their levels of diversity, no consistent pattern was apparent in the modest differences that emerged on questions assessing interns' attitudes about their companies' practices related to diversity of race/ethnicity, gender, or age, except as related to role models reported above.

Given the dearth of minority students and professionals in the science pipeline, it is not unreasonable to assume that, by the sophomore year in engineering school, students have already developed a level of comfort and familiarity with non-diverse environments.

Conclusions

Our investigation has led us to four overarching recommendations for organizations interested in creating successful mentoring programs.

Recognize the Value of Teaming

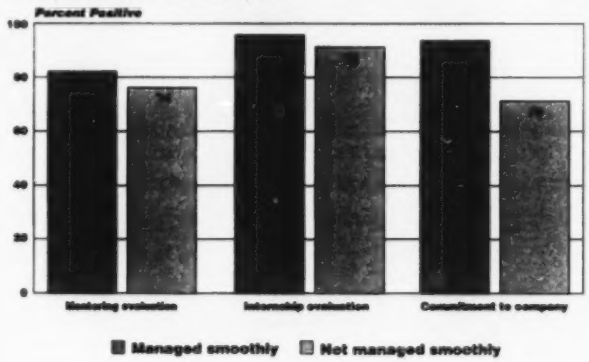
- Create opportunities for interns to serve on company teams and, wherever possible, assign mentors to serve alongside interns on company teams.

Teamwork is the hallmark of engineering excellence in the 1990s. Increasingly, companies spend both time and resources to develop high-performing teams, instill team spirit and balance the competing values of individual achievement and team performance. That interns thrive in such an environment is not surprising. But there is some revelation in the fact that being mentored by a team member is so enriching. Common wisdom has suggested that the mentor should be removed from the immediate environment of the protégé to foster openness and remove the threat that

Figure 17.

Management of Interns' Living Arrangement

Impact on Student Perceptions



might come from mutual dependence or direct reporting lines. Our data do not support that model. Students are well nurtured when they and their mentors share goals, workspace and colleagues.

Invest Time in Developing Engineering Talent

- Encourage mentors to spend substantial quality time with interns, investing a minimum of three hours per week;
- Encourage supervisors to give regular feedback to their interns and to spend at least three hours per week with them;
- Encourage mentors to let students know they will be available to interact with them following the internship;
- Assure that mentors have regular interaction with their interns during the academic year.

Time spent by significant adults (parents, professors, mentors/supervisors, professional colleagues) with young people prepares them for adulthood, and they know it. They gain knowledge, and acquire important soft skills (e.g. understanding corporate culture, work habits and modes of communication) that prepare them for success. It is not surprising, therefore, that NACME scholars responded positively to the time spent by corporate mentors and supervisors, and preferred spending more time on the job with such adults over less. More time spent with mentors during the summer internship led interns to seek opportunities to interact with them during the academic year, cementing the bond between interns and companies and providing students with important academic resources during the school year. Accordingly, investing time in interns is a win/win situation.

Respect the Ambition and Abilities of Interns

- Create work assignments that engage the interns' technical expertise, use their academic skills, and relate to their future coursework and career goals;
- Provide a measure of freedom to students in selecting their assignments.

Supervisors may be hesitant to entrust young interns with challenging technical assignments because they doubt that students have had the technical courses related to successfully tackling the work. As a result, they may assign interns to projects requiring less technical background, like developing a web-page for a department, editing a technical manual, etc. Interns, however, much prefer more technically demanding assignments, as indicated by such comments as: "My assignment lacked real challenge," "My work was simple and taught me nothing," "I learned very little in my area of expertise." On the other hand, those scholars who were given the greatest technical challenges were the happiest with their internship experiences. None of the interns reported that they had been overchallenged by the technical requirements of their assignments, and many reported that they had been underchallenged. This represents an excellent opportunity for companies interested in nurturing outstanding performance while building enduring relationships with their interns. By creating assignments that demand high level technical skills, supervisors can build a stimulating learning environment for the student and a strong investment for the company. Placing such an assignment in a team environment can mitigate hesitancy about student academic preparation.

Engage Interns in Exploring Future Possibilities

- Facilitate meetings through which interns can meet potential role models, where possible, of their own race/ethnicity.

Mentors and supervisors who invest time getting to know their protégés should achieve an understanding of the goals and aspirations that are driving the student's interest in engineering. Using that knowledge to create opportunities for students to meet successful professionals who share their ambitions is an outstanding service to career development.

Our findings suggest that companies eager to develop technical talent,

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especially of underrepresented minorities, have opportunities to use improved internships to develop new employees, stem the loss of excellent prospects and improve the motivation, commitment and retention of aspiring engineers. Given the recent declines in enrollments of freshman engineering students, minority and nonminority, companies can anticipate an even greater challenge in recruiting and retaining engineers for their workforces. Satisfying internships hold great promise for increasing the likelihood that interns will select the companies that host them as future employers.

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Endnotes

1. George Campbell Jr., "Engineering and Affirmative Action: Crisis in the Making," *NACME Research Letter, Special Edition,* (November, 1997).
2. U.S. Department of Labor, Bureau of Labor Statistics, *Economy at a Glance,* May, 1998. http://www.bls.gov.
3. Catherine Morrison, Kenneth Griffin and Peter J. Marcotullio, "Retention of Minority Students in Engineering: Institutional Variability and Success," *NACME Research Letter* Volume 5, Number 1 (December, 1995)
4. The CSP interns majored in 11 engineering disciplines at 38 universities and interned at 24 companies. Two out of five were female and the rest male. Fifty-four percent were African American, 42 percent Latino and four percent American Indian. More than one-half (58 percent) completed internships at the end of their sophomore year and the majority of the rest, 34 percent, did so at the end of their junior year. Twenty-three of the 24 companies hosting interns during the summer of 1997 are represented in the supervisors' database.
5. NACME conducted two tests to assess the impact of non-responses on the averages reported for the supervisors. Both produced insignificant differences in the response patterns of respondents and non-respondents.
6. Elaine Seymour and Nancy M. Hewitt, *Talking About Leaving: Factors Contributing to High Attrition Rates Among Science, Mathematics & Engineering Undergraduate Majors.* Chapter 13. Bureau of Sociological Research. Boulder, CO. (April, 1994)
7. One in four supervisors served simultaneously as mentors for the interns.